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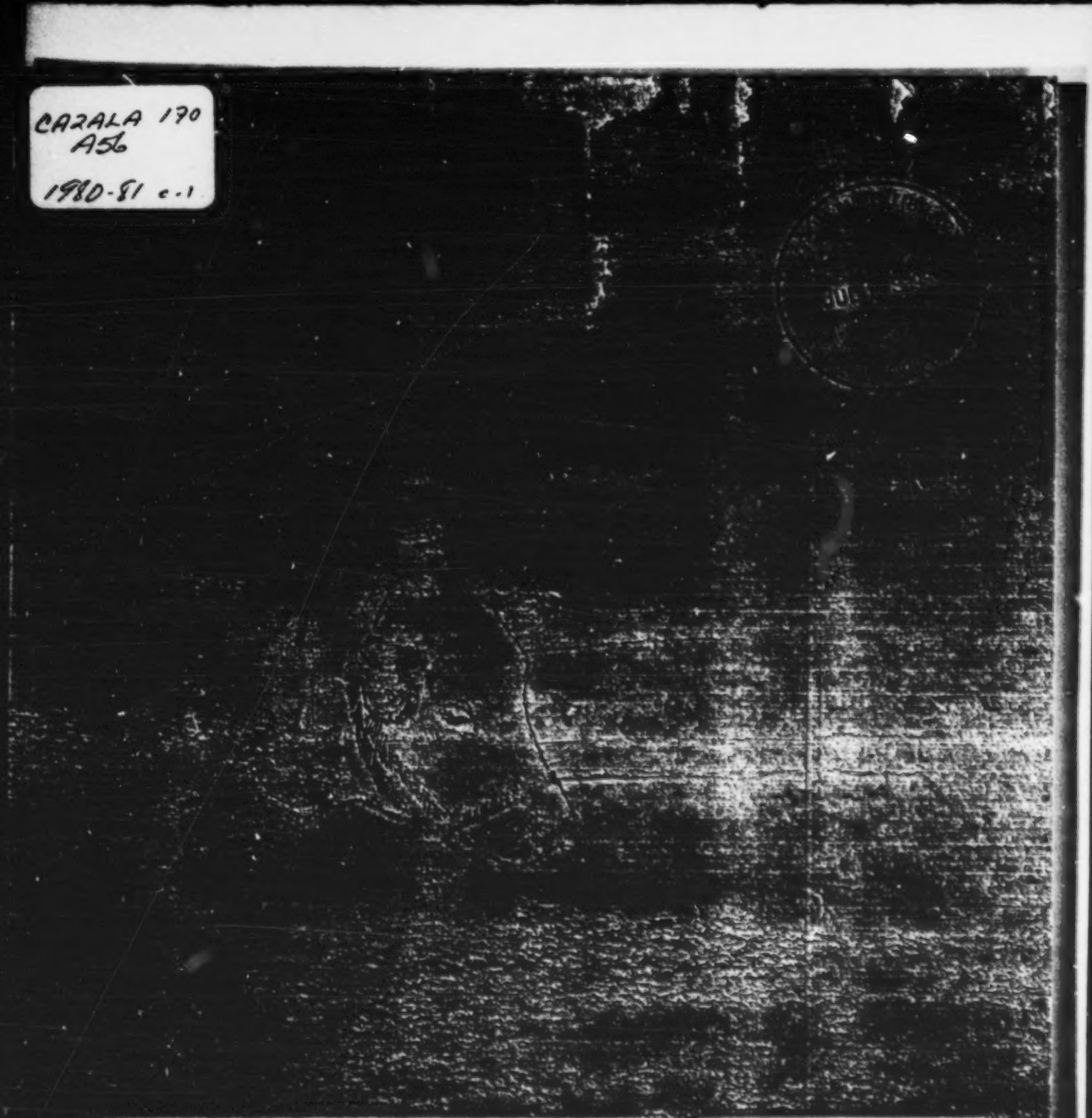

THE ALBERTA AGRICULTURAL RESEARCH TRUST 1980-1981 *Annual Report*

Tribute to
Dr. James G. O'Donoghue

Alberta's agricultural research sector lost a most important friend with the death this past July of Dr. Jim O'Donoghue, Chairman of the Alberta Agricultural Research Trust Board of Trustees.

Known to most of us as Deputy Minister of Alberta Agriculture, a man with the ability to keep a level head during the hottest of events, Dr. O'Donoghue probably exercised his greatest influence on the future of the province's agriculture industry through his broad support of research activities.

One could gain an appreciation of that support through his annual remarks in this space. In last year's report he said, "If (agriculture) is to continue to fulfill its role as the cornerstone of the province's resource base, then research is required to correct yesterday's errors, overcome today's problems and meet tomorrow's market demands."

It was the practical view of a man who was involved in the practical end of agriculture for much of his life. After receiving his DVM from the University of Toronto and following a short stint with the Federal Health of Animals Branch in the mid-1940s, Jim O'Donoghue came to Alberta where he was employed as a practicing veterinarian by the provincial government for 17 years.

During that time he pursued the benefits of animal health programs both in his own practice and through urging others to follow suit. On his own he helped to pioneer remedies for vitamin A deficiency in cattle and studied the effects of various industrial chemicals on the health of animals.

Rising through the executive ranks of the Department, first as Director of Veterinary Services, next as Assistant Deputy Minister for Production and finally as Deputy Minister, Jim O'Donoghue's efforts were always characterized by looking to the extension value of any research work in which he was involved. One would guess it was almost natural after being involved in extension activities for so long — he appreciated that progress could only be made through the actual implementation of new technology, a process that even now needs to be streamlined to allow its quickest possible introduction.

Similar values have shown up in the work undertaken by the AART. Whenever possible, funding is still offered on a joint industry-Trust basis to ensure that industry contributes to and remains aware of the value of research to its own progress. However, Jim O'Donoghue knew that some projects would never be undertaken by the private sector, and he supported the idea that some AART funds should be reserved for projects that were important but would receive no interest outside of research circles.

Dr. O'Donoghue's respect for the value of research did not stop with the Alberta Agricultural Research Trust. He continued to pursue the idea of a broad-scale research effort by the province, a goal he achieved with the introduction of the Farming for the Future program which is funded out of the Alberta Heritage Savings Trust Fund. That program has since utilized much of the unused research capacity, facilities, manpower and expertise, that existed in the province.

The combined efforts of Farming for the Future and the Alberta Agricultural Research Trust mean much of the province's future progress in agriculture will be derived from technology developed and funded from within the province. It is a goal that has meant a great deal to many, and no one more than Dr. Jim O'Donoghue.

Chairman's Report

Agriculture is a crucial cornerstone in Alberta's economic future. While often called a 'renewable' resource, agriculture is still subject to the same conditions that affect other areas of our economy — the need to obtain the most efficient possible production, to overcome production obstacles such as diseases or pests, to improve existing products, to find new products, both raw and processed, and then get them into production, to obtain for those involved in the industry the best possible return and to ensure there is a viable industry for generations who follow.

While some of these needs result directly from the economic climate of the times, all are influenced to some degree by the availability of new technology. Research is the means to obtain that technology. Therefore, getting that research initiated is something that is crucial to the future of the agriculture industry in Alberta.

Fortunately, it is a need that has been recognized. It led directly to the creation of the Alberta Agricultural Research Trust (AART) in 1966, and since then has helped to ensure its continued existence.

Over that period, true to its original purpose, the AART has coordinated and financially supported agricultural research undertaken by private industry, farm associations and organizations, Alberta Agriculture and various educational institutions.

The Board of Trustees, representative of various aspects of the agricultural community, is responsible for the operation of the Trust. Funding is awarded on a project basis with new applications and renewals being submitted annually. All applications are reviewed and recommended by the AART Grants Committee before forwarding to the Board of Trustees for final approval.

A $500,000 grant from Alberta Agriculture provided the Trust's first funding support. Since 1967, the Department has continued to support the Trust with minimum annual grants of $250,000. Of this amount, $50,000 is annually allotted for projects unsupported by the private sector although the majority of the funds are issued to projects known to have industry support. The AART strongly encourages private sector participation through cooperative project funding, usually on a matching 1:1 basis.

As of the end of March 1981, more than 300 AART-supported research projects had been undertaken. Over the last 14 years, these projects have received more than $5.0 million in AART funds. Usually mission oriented, the projects have involved all aspects of agriculture production.

The policy of the Board of Trustees is to first support research that will be undertaken in Alberta. The majority of AART projects have been conducted at the University of Alberta while a number have also been handled at the University of Calgary. Where a specific research capability does not now exist in the province, support may be directed to out-of-province agencies such as the Western College of Veterinary Medicine in Saskatoon. However, in line with the Board's policy, the work must be of valid interest to Alberta's agriculture industry.

On behalf of the Board of Trustees of the Alberta Agricultural Research Trust, I extend our appreciation to the participating research scientists, the Grants Committee and to those organizations and businesses which have continued to provide financial support to agricultural research activities in Alberta.

H.M. Douglas
Acting Chairman, Board of Trustees

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AGRICULTURAL ENGINEERING

RAPP, E.

A study of sprinkler system uniformity and efficiency

A simulated model of two center pivot (C.P.) sprinkler irrigation systems (Circle Master and Valley 1160), operating under local climatic conditions, was developed to examine the effect of wind on the uniformity of water distribution and to evaluate the systems' performance under actual windy conditions. The uniformity coefficients were affected by both the wind velocity and wind direction. However, the effect of wind direction was more pronounced. Performance of the C.P. systems was determined from field measured application depths as well as those simulated by the model. In general the field coefficients were lower than the simulated coefficients but both the field and the simulated coefficients were within the acceptable level of 80-90%.

ANIMAL SCIENCE

AHERNE, F.X., R.O. PARKER, B.A. YOUNG

Piglet survival: the first seventy-two hours

Compared to other farm animals the sow produces a large number of offspring at birth, but baby pig mortality claims 20-25% of those born. A survey of producers in the environs of Edmonton was conducted to collect data on the occurrence and possible causes of piglet mortality during the first seventy-two hours post-partum. Data collected from these producers were compared to published surveys on piglet mortality and data collected at The University of Alberta Swine Research Unit. Total piglet mortality figures from the Edmonton area producers was 18.9% for the first seventy-two hours post-partum, which is similar to results of large published surveys conducted in Canada, England and U.S.A. Piglet deaths were mostly attributed to still births (6%) and those which occurred the first day of life (10.1%). Compared to data from farrowings at The University of Alberta Research Unit, where farrowings were attended, producer mortality values were high. Including stillbirths, the total mortality at the University Research Unit for the first three days post-partum was only 6.8% which indicates that close supervision during farrowing and the early post-partum period greatly improves piglet survival. Two other observations were noted regarding dead piglets collected in the Edmonton environs. Firstly, body weights were low (1.0 kg) with many pigs weighing less than 0.8 kg. Second, more than 80% of the piglets which died during their first three days of life, died with empty stomachs suggesting that they never suckled.

AHERNE, F.X., P.E.V. WILLIAMS, R.O. PARKER, B.A. YOUNG

The relationship between pregnant sow metabolites and the fetal pig

The transfer of lipid from the pregnant sow to the fetal pig is poorly understood. Increasing levels of lipid in the piglet may be beneficial in increasing his thermogenic capacity. Researchers have shown that in some species raising the levels of serum free fatty acids in the dam during pregnancy may result in increased fat transfer to the fetus. In an experiment involving 30 sows and three different feeding systems, levels of peak serum free fatty acids were increased by up to 100 percent over the last 30 days of pregnancy in sows fed on alternate days compared with those fed once or twice daily. There was no effect of the sow nutritional treatments on piglet birth weight, total carcass lipid, liver glycogen or the response of the piglet to a 90 min. cold test at 5°C. The results show that the placenta and fetal unit of the sow are highly resistant to serum changes in the pregnant sow. This may partly explain the unsuccessful attempts to influence piglet carcass composition by the addition of fat to the diets of pregnant sows.

AHERNE, F.X., R.O. PARKER, P.E.V. WILLIAMS, B.A. YOUNG

Serum thyroid hormones of warm (30°C) and cold (10°C) farrowed piglets

It has been suggested that chilling is directly and indirectly responsible for more early piglet deaths than any other single factor. This is due in part to their large surface area in relation to their weight, poor hair coat, very small body fat reserves and poorly developed temperature regulation mechanisms. Thyroid hormones, thyroxine (T_4) and triiodothyronine (T_3) are known to be involved in thermoregulatory mechanisms. In order to investigate the effects of environmental temperature at farrowing on serum levels of T_4 and T_3, and survival of the neonatal pig, four days

prior to expected farrowing six sows were moved to farrowing crates in a room maintained at 10°C. Nine other sows remained in the farrowing unit at The University of Alberta farm which was maintained at 30°C. At birth (0 hour), 6, 12 and 24 hours piglets farrowed at 10°C and 30°C were blood sampled by vena cava puncture. Serum T_4 and T_3 levels were measured by radioimmunoassay. Thyroxine decreased similarly in warm (30°C) and cold (10°C) farrowed piglets ($P<0.05$) from 10 µg/dl at birth to 6 µg/dl at 24 hours. Triiodothyronine was low (<1 ng/ml) at birth in piglets farrowed at both temperatures. However, by 24 hours after birth T_3 was two times higher ($P<0.05$) in cold (10°C) farrowed pigs than in warm (30°C) farrowed pigs (1 ng/ml vs 2 nlg/ml). Mortality of the cold farrowed piglets was 29% for the first 24 hours of life while the mortality of the warm farrowed piglets was 9%.

AHERNE, F.X., R.O. PARKER, P.E.V. WILLIAMS, B.A. YOUNG

Postnatal development of cardiac distribution in the pig

Distribution of cardiac output was measured in 0 and 12 h old piglets using ^{103}Ruthenium-labelled microspheres 15±3µ in diameter. The 12 h old piglets had remained with sow and had suckled. Coronary and bronchial fractions of cardiac output were high in piglets at birth. The coronary fraction remained high at 12 h but the bronchial fraction decreased significantly ($P<0.05$). Percent cardiac output to the liver and upper gastrointestinal tract, pancreas and salivary gland in 12 h old piglets was significantly increased ($P<0.01$) by 138, 156, 85 and 109 percent, respectively, compared with piglets at birth. Preferential blood flow occurred to the lungs, adrenals, heart, thyroid and spleen at 0 h and to the adrenals, thyroid, heart, lungs and diaphragm at 12 h.

AHERNE, F.X., R.O. PARKER, P.E.V. WILLIAMS, B.A. YOUNG

Histological structure of the thyroid gland in the neonatal pig

The histological structure of the thyroid glands from 115 piglets that were stillborn or slaughtered at 0, 6, 12, 24, 48 or 72 h of age were examined. Thyroid follicle diameter decreased ($P<0.05$) after birth and then increased ($P<0.05$) by 72 h. Thyroid glands from stillborn piglets contained follicles whose diameters were similar to those observed in 72 h piglets. Thyroid follicles at all stages of development contained colloid and were surrounded by mainly cuboidal-columnar epithelium.

AHERNE, F.X., P.E.V. WILLIAMS, R.O. PARKER, B.A. YOUNG

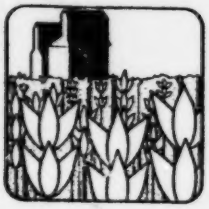
Distribution of blood flow in cold stressed piglets

Radioactive ^{103}Ruthenium labelled microspheres 15±3µ in diameter were used to determine cardiac distribution in unfed control (35°C) and unfed cold stressed (5°C) piglets 3.5 h of age. The cold stress produced an average 7.10°C drop in rectal temperature. Piglets responded to cold with a redistribution of blood flow. Adrenal fraction of cardiac output fell significantly ($P<0.05$) from 0.56 percent in the control to 0.29 percent in the cold exposed piglets, however, the relative blood flow to the adrenals remained higher than for other tissues. The fractions of cardiac output reaching the psoas and biceps muscles significantly increased ($P<0.05$) by 148 and 266 percent respectively during cold exposure. Skeletal muscle fractions of cardiac output and the relative importance of these muscles increased during cold exposure. Percent cardiac output to the heart, brain, alimentary tract, skin and fat was not significantly ($P<0.05$) affected by cold exposure.

AHERNE, F.X., R.O. PARKER, P.E.V. WILLIAMS, B.A. YOUNG

Serum and urinary levels of thyroxine and triiodothyronine in the neonatal pig

Thyroid hormones, thyroxine (T_4) and triiodothyronine (T_3) are necessary for proper thermoregulation and postnatal growth and development of pigs. However, very little information exists regarding thyroid function and serum level of thyroid hormones in the neonatal pig. To investigate circulating and urinary levels of T_4 and T_3 in the neonatal pig, serum and urine samples were obtained from 5 piglets in each of 10 litters via vena cava and bladder puncture. Samples were obtained at birth (0 hour), 6, 12, 24, 48, 72 and 240 hr postnatal. At each sampling period, hematocrits were determined, body weights recorded, and colostrum was collected from the sow. Serum, urinary and colostrum levels of T_4 and T_3 were measured by radioimmunoassay. Hematocrits declined ($P<0.01$) from 38% at birth to 27% by 12 hours, remained at this level through the 48 and 72 hour sampling, and then increased ($P<0.05$) to 36% by 240 hours. Total serum T_4 was high (8.7 µg/dl) at birth but declined ($P<0.01$) by 24 hours to 5.3 µg/dl and remained at this level through 240 hours after birth. In contrast, total serum T_3 was less than 1 ng/ml at birth and more than doubled ($P<0.01$) to more than 2 ng/ml by six hours. Serum T_3 decreased ($P<0.01$) to near 1 ng/ml by 12 and 24 hours after birth. By 48 hours T_3 again increased ($P<0.01$) to more than 2 ng/ml and remained elevated through 240 hours. Concentrations of T_3 and T_4 in the urine were low at birth but increased ($P<0.01$) to more than 1 ng/ml by 24 hours, and then gradually decreased through 240 hours after birth. Neither T_4 nor T_3 was detected in the colostrum of these sows. Statistical analysis revealed that larger piglets had higher T_3 levels and that piglets which had high T_4 levels also had higher T_3 levels.



PLANT SCIENCE

HORAK, A.

Prediction of seedling vigor in wheat by ATP determination on dry seed

The relationship between wheat seed ATP content, germination and seedling vigor was examined in seventy-five spring wheat (*Triticum aestivum L.*) genotypes from the University of Alberta utility wheat breeding program in order to investigate whether a biochemical assay applicable to dry seeds could be used for screening for rapid germination under cool and normal temperatures. No relationship was found between seedling vigor and establishment in the field and the ATP content of dry seed, or with seedling vigor determined by controlled germination tests in growth cabinets at 14°C or 18°C, indicating that the ATP determination on dry seed may not be a useful method of predicting germination energy or seedling vigor. The study indicated that the most useful variables to measure in future field studies of seedling vigor of different genotypes will be the dry weight at the five-leaf stage, supplemented by plant mortality rates based on stand counts at the two- and five-leaf stages.

RURAL ECONOMY

APEDAILE, L.P.

The effect of management variables on economic returns in irrigated agriculture

Management and labour are often indistinguishable inputs to farm operations yet are clearly separate functions in terms of their role in increasing production. This research attempted to isolate the returns to management and to identify the factors which influence management, to provide a basis for improving farm management extension for irrigated agriculture in southern Alberta. The results, while inconclusive due to irresolvable multicollinearity and dominance problems in the models, tend to indicate little evidence that the conventional focus of farm management contributes to net returns on irrigated farms.

On 90 randomly chosen farms, 30 apparently independent factors were measured and related to net farm income. These factors were classified into three groups: descriptive of the manager and his activities; levels and combinations of farm resources and inputs; and the manager's attitudes and expectations toward management issues. The second group of factors, especially land base, outweighed all other factors which are usually thought to account for returns to management. However, the willingness to change with technology, the willingness to take risk, and a stable, smooth functioning personality were also positively, though not significantly, related to higher net farm income.

It is concluded that income performance depends largely on how many resources are accumulated, rather than on the way in which these resources are managed, although stable, flexible, confident personalities may also be conducive to higher incomes. Interpretation of these conclusions is that the larger the farm operation within the observed range, the less likely is poor management, in the conventional sense, to impinge on income. Conversely, for smaller operations, good management is not as important as personality, attitudes and resource acquisition for increasing income. Finally, it appears unlikely that management in the conventional sense can be steered to produce measurable results in net farm income on irrigated farms in southern Alberta.

PHILLIPS, W.E.

Multiple land use effects of beef cattle production in the foothills region of southern Alberta

Land use conflicts among ranching, wildlife and outdoor recreation were occurring in southwestern Alberta at the time of this study. The purpose of the study was to examine resolutions of this conflict in an economic framework. The study determined that economic returns to land from ranching ranged from –23.66 to 11.85 dollars (1972 dollars) per acre with an average return per ranch of 2.08 dollars per acre. Hunting and fishing net returns from wildlife combined with other forms of outdoor recreation net returns amounted to approximately 2.8 million dollars (1972 dollars) annually. Conflicts among ranching, hunting and fishing and nonconsumptive recreational activities precluded certain complementary resource uses. At the

same time there were locations within the region where biological competition existed. Despite low economic returns to ranching at the time only moderate land resource shifts from ranching to wildlife and certain forms of recreation should have taken place to improve social net benefits from resource use. Measures suggested to facilitate this shift included land consolidation, habitat improvement on both private and public land with rancher cooperation, greater public access, and guarantees to landowners against increased social costs that would otherwise be incident upon them. Increased communication between interest groups was proposed to help facilitate the implementation of the integrated land management program in southwestern Alberta.

SOIL SCIENCE

COOK, F.D.

Development of an alfalfa variety resistant to alfalfa "sickness" and distribution of the "fungus" in central and northern Alberta

The condition known as "alfalfa sickness" appears to be caused by a number of plant pathogenic microorganisms that form necrotic lesions on roots of alfalfa plants.

In the present work, it was found that both pathogenic fungal species and known bacterial pathogens in combination are able to cause the disease. The following bacteria *Pseudomonas fluorescens, Erwinia carotovora, Chromobacterium violoceum* and a new *Cytophaga* species were found in diseased roots of alfalfa growing in the district around the town of Malaig. Some 100 bacterial isolates were examined and all were found to cause necrosis of healthy alfalfa root tissue. Both bacteria and fungi are involved in the disease. Control of this disease through breeding for resistant varieties will be more difficult because the disease is caused by a complex of microorganisms.

McGILL, W.B., M. MONREAL, S.S. MALHI

Factors affecting the fate of mineral N in soil

This study examined both nitrification and denitrification. Results indicate that nitrifying bacteria adapt to the temperature regime of a region. Consequently, it is not possible to extrapolate data on temperature effects on nitrification rate in soils of one climatic region to another. A simple model has been developed relating nitrification rate in some central Alberta soils to ammonium supply and soil temperature and moisture. It works reasonably well but inclusion of nitrifier population size appears necessary to make it more broadly applicable. However, as it stands, it predicts overwinter nitrification rate reasonably well. We can now more clearly understand the fate of fall-applied broadcast fertilizer or of mineral N in fallow soils.

Studies on denitrification have indicated the following: a) nitrate loss under anaerobic conditions in closed systems can be taken as a measure of denitrification, since our ^{15}N studies have shown about 94% of the NO_3^- lost is released as gas and only about 6% remains as organic N and NH_4^+ combined; b) denitrification appears to occur (although very slowly) even at –4°C; c) denitrification rate can be calculated knowing the nitrate supply, soluble C supply; denitrifier population, temperature and moisture; d) soluble C supply appears to alter denitrification rate and potential both within a given soil receiving different management practices and between soils; e) the supply of soluble C to the soil solution appears to be strongly affected by desorption and can be expressed in the form of a modified Freundlich isotherm. Normally, the Malmo SiCl had a soluble C content about three times that of the Breton L. Air drying increased soluble C content, as did anaerobic incubation in the absence of NO_3^-–N.

The results of this study allow two very rough generalizations: a) about 30 kg N ha^{-1} could be nitrified (if the NH_4^+–N were available) overwinter (five months at 0°C; one month at 4°C); and b) that amount of N could be denitrified in waterlogged soil at 0°C in eight days in many Black Chernozemic soils of central Alberta and about half that amount in Luvisolic soils such as Breton.

McGILL, W.B., D.W. BERGSTROM, G.A. SPIERS

Preliminary evaluation of soil phosphatase activity as a soil test parameter

Examination of soil phosphatase activity is important because of the role these enzymes can play in hydrolyzing organophosphates to release orthophosphate necessary for plant and microbial nutrition. The objective of this project was to study the controls on soil phosphatase activity,

providing information for a necessary background to applications in soil testing and fertilization practices.

The phosphatase activity of Ap horizons of 2 soils (a Black Chernozem and a Grey Luvisol) was characterized with respect to pH optima and kinetic parameters. Results showed that phosphatase activity in both soils contained an acid and alkaline component.

The effects of phosphate concentration of the soil solution on existing phosphatase activity and on the production of new phosphatase by soil microorganisms was studied. Results showed that production of phosphatase by growing soil microorganisms is more easily repressed than is the activity of the pre-existing enzyme in soil; therefore the effect of orthophosphate on phosphatase activity in soil is due more to its effect on enzyme synthesis than on the activity of pre-existing enzyme.

A laboratory experiment using the Ap horizon of a Grey Luvisol followed changes in acid and alkaline phosphatase activity, microbial respiration rate, and the level of available phosphorus over time after the addition of carbon and nitrogen with and without added phosphorus. Synthesis of acid and alkaline phosphatase was repressed by added phosphorus, and derepressed in the absence of added phosphorus. A high level of phosphatase activity after the respiration rate had declined indicated the persistence of active enzyme not associated with actively growing cells.

A field experiment was carried out to observe the seasonal variation in alkaline phosphatase activity in a Black Chernozem under barley, and under an alfalfa-brome mixture, with various fertilizer treatments. There was a significant increase in phosphatase activity over the growing season and into the fall under the barley, while under the alfalfa-brome mixture there was only a slight increase.

Soil samples (Ap horizon) from the Breton Plots on a Grey Luvisol were assayed for acid phosphatase activity to observe the effect of rotation and fertilizer treatment after a time interval of approximately 50 years. For some plots phosphorus fertilization depressed soil phosphatase activity; in other cases this effect was masked by increased plant production and subsequent increased phosphatase activity caused by fertilization.

NYBORG, M.P.K.

Sulphur studies

It was shown, in field experiments on sulphur deficient soils, that nitrogen fertilizers decreased the yield of rapeseed. Sulphur fertilizers did not increase the yield of rapeseed, but the application of nitrogen and sulphur fertilizer greatly increased the yield of rapeseed. After these results were published this behavior of rapeseed has been found to occur on sulphur-deficient soils across western Canada. A recent field experiment conducted under this project indicated that brome grass hay behaves the same way in that on sulphur-deficient soils nitrogen fertilizer by itself produces a substantial decrease in the yield of hay.

NYBORG, M.P.K.

Use of lime on Alberta soils

The purpose of this research work was to find the extent of cultivated acid soils throughout Alberta. This A.A.R.T. project was conducted as a portion of a larger, co-operative project carried out with the Beaverlodge Research Station, the Agricultural Soil and Feed Testing Laboratory, and the Soils Branch. The field work consisted of 28 field plots conducted for 3 years, on soils of different degrees of acidity. Four crops (barley, rapeseed, alfalfa, and red clover) were grown with and without lime and with and without nitrogen fertilizers.

It was found that nearly one-fifth of the farmed land in Alberta was acid as measured by a soil pH of 6.0 or less. On most of these soils alfalfa grew poorly. On the more acid soils (pH less than 5.5) barley, rapeseed, and red clover usually grew poorly as well. With the liming of the acid soils, crop yields were attained comparable to those on neutral soils.

Nitrogen fertilizers were found to make Alberta soils slowly acid, but results showed this acidification of soils could be avoided by some unconventional methods of application of the fertilizer.

NYBORG, M.P.K.

Increasing the efficiency of nitrogen fertilizers

Field experiments in northern Alberta and northern Saskatchewan over a period of seven years, showed that urea fertilizer applied in fall gave only about one-half as much increase in the yield of barley as did the urea applied in spring.

The inferiority of fall-applied urea was apparently caused by denitrification which converts nitrate to nitrogen gases in wet soils. These losses were approximately as great with ammonium sulphate, ammonium nitrate, and aqua ammonia as with urea. Losses from fall-applied nitrogen

fertilizer were slightly reduced by band placement, and greatly reduced by placing the fertilizer in big pellets or in nests. The band placement, or the pellet or nest placement, of the fall-applied nitrogen fertilizer may with time become a practical method for farmers.

EXTENSION

LAMBLE, W.

Role conflict and ambiguity of agricultural extension agents

The purpose of this study was to explore the potential utility of role theory in understanding organizational behavior phenomena and suggest administrative activities and practices that should reduce and/or maintain role conflict and role ambiguity at functional levels for extension agents in the Extension Division of Alberta Agriculture.

Role ambiguity occurred at lower levels but was more serious in its consequences than role conflict for District Agriculturists. Experienced role ambiguity, including both task and social-emotional role ambiguity, was related to adverse personal outcomes of job dissatisfaction, perceived personal and organization ineffectiveness, and propensity to leave the organization. Experienced role conflict was related only to job dissatisfaction and perceived organizational ineffectiveness. However, the relationship of role conflict with personal outcomes depended upon the particular type of role conflict.

Recommendations were made regarding recruiting, selection, and development of District Agriculturists as well as program planning practices for the organization.

UNIVERSITY OF BRITISH COLUMBIA

BEAMES, R.M.

Nutritional evaluation of high lysine barley

Co-operative work on the Alberta Agriculture high-lysine barley breeding programme has been in progress since 1976. Samples submitted each year have been analyzed for content of amino acids and nitrogen and in several years rat feeding tests have been conducted. The results indicated the high protein, high lysine content of early selections to be adequate for satisfactory growth in weanling rats. Extrapolation would suggest this protein level to be sufficient for optimal growth in growing-finishing pigs. Later samples of lines homozygous for the high lysine gene gave somewhat poorer results. However, these samples came from markedly improved cultivars which now had a yield similar to that of Galt. The next step in the breeding programme is to regain the lysine content. Chemical tests are still in progress to develop a rapid, accurate method for measuring available lysine content.

UNIVERSITY OF SASKATCHEWAN

MURPHY, B.D.

Studies of ovulation and embryo survival in mink

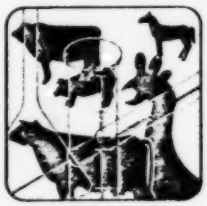
The experiments performed using the funds provided by the A.A.R.T. met three objectives. The first objective was to determine whether injection of a brain hormone (gonadotropin releasing hormone or GnRH) could reduce labour costs by eliminating the first mating in mink. Results

demonstrated that 2 micrograms of GnRH was effective in eliminating the need for the first mating in Pearl variety mink with no apparent reduction in fertility. The results in Pastel mink indicated that a 10-12 percent decline in reproductive success was associated with this treatment.

The second objective of the present experiments was to determine whether the hormone used above (GnRH) could induce ovulation. Laboratory studies demonstrated that 2 µg of GnRH induced release of ovulatory hormone and induced ovulation in mink.

The third objective of the study was to explore the hormonal aspects of the stimulus which induces embryo implantation in mink in hopes of improving embryo survival. Capsules releasing the ovarian hormone progesterone, implanted beneath the skin of mink soon after mating and removed before whelping, improved reproductive success. A more practical means of producing the same effect may be the injection of a long-acting synthetic progesterone (medroxyprogesterone acetate or MPA). The ability of MPA to maintain pregnancy in animals whose ovaries had been removed was investigated. MPA enhanced embryo retention prior to implantation relative to ovariectomized, untreated mink. MPA maintained the uterus in these animals but did not induce implantation. In mink whose ovaries were removed after embryo implantation, MPA maintained the uterine environment.

The mechanism by which the lengthening days induce embryo attachment in mink was studied. Previous experiments had shown that the pituitary gland was necessary for implantation to occur. One experiment in the present study demonstrated that the pituitary was necessary for maintenance of pregnancy after embryo implantation, and the pituitary hormone prolactin (PRL) may be involved in this process. A subsequent experiment demonstrated that PRL could induce embryo implantation and produce ovarian progesterone secretion similar to intact animals influenced by the extended day length. It therefore was concluded that PRL is the hormone whose release by photoperiodic stimulation induces embryo implantation.



ONTARIO VETERINARY COLLEGE

MILLER, R.B.

An investigation into the prevalence, pathogenesis and pathology of Haemophilus somnus *infections of the reproductive tract in cows*

H. somnus is an important cause of disease in feedlot cattle and is frequently isolated from the vaginal secretions of cows and occasionally from the placenta in association with abortions. An investigation was conducted to determine the frequency of infection and the importance of this organism in genital tract disease of cows. In an abattoir survey 8 of 100 bovine reproductive tracts sampled were found to contain the organism and the vagina was the usual site of isolation. Following introduction of *H. somnus* into the reproductive tract of pregnant cows, it was found that the organism traversed the cervix and grew well in placental membranes. Signs of disease were most frequently confined to the placenta resulting in retention of the fetal membranes and, when inoculated into the uterine artery, abortion of the fetus. Infection was rarely followed by the development of severe inflammation in the uterus with death of the cow. Introduction of *H. somnus* into the cervix of cows or heifers at estrus was irregularly accompanied by infertility which was considered to be temporary, that is, for one or two cycles only. Considering the near worldwide distribution of the organism and the frequency of its occurrence in the vagina of cattle, *H. somnus* would appear to be an important pathogen of the bovine reproductive tract.

CONTINUING GRANTS

Date following title identifies Annual Report in which project description appears

AGRICULTURAL ENGINEERING

HARRISON, H.P.
Potato damage losses (1974-1975)

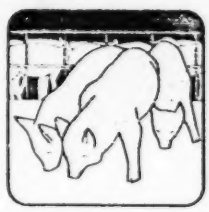
McQUITTY, J.B.
A system analysis of environmental control in total confinement livestock production (1972-1973)

McQUITTY, J.B.
Heat and moisture loads in swine feeder barns (1976-1977)

McQUITTY, J.B.
Hydrogen sulfide control in anaerobic pig manure (1979-1980)

RAPP, E.
Evaluating drainage feasibility of some Alberta soils (1972-1973)

RAPP, E.
Irrigation scheduling for supplemental irrigation in central and northern Alberta (1979-1980)



ANIMAL SCIENCE

AHERNE, F.X.
The effects of rapeseed supplemented diets on swine performance, color and pH of pork (1979-1980)

CHRISTOPHERSON, R.J., J.R. THOMPSON
Cattle hormones — influences of environment and relevance to production (1978-1979)

HARDIN, R.T.
Rate of tissue growth and changes in body composition (1968-1969)

HARDIN, R.T.
Recombination of quantitative traits in sheep (1968-1969)

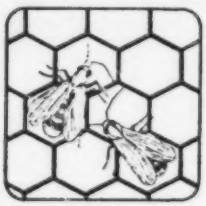
MATHISON, G.W.
Supplementation of straw diets for beef cattle (1977-1978)

MATHISON, G.W., L.P. MILLIGAN
Thiamin supplementation of high-grain diets for feedlot steers (1978-1979)

SAUER, W.C.
Evaluation of high lysine barley in pig starter diets (1978-1979)

THOMPSON, J.R.
Molecular composition of protein from specific muscles of meat-producing animals (1971-1972)

YOUNG, B.A.
Climatic influences on nutrition of cattle (1977-1978)



ENTOMOLOGY

MITCHELL, B.K.
Sensory systems important in feeding behaviour in the adult red turnip beetle (1978-1979)

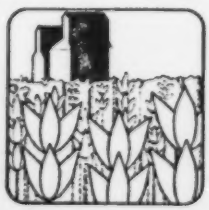
FOOD SCIENCE

JACKSON, E.D.
Evaluation of the keeping quality and causes of reduced shelf-life in pasteurized fluid milk produced by Albertan dairies (1979-1980)

JELEN, P.
Aqueous extraction of rapeseed oil (1975-1976)

LeMAGUER, M.
Aqueous food freezants (1979-1980)

OORAIKUL, B.
Flexible packaging of perishable foods (1979-1980)



PLANT SCIENCE

BAILEY, A.W.
A brush control system for controlling aspen forest using herbicide followed by fire (1979-1980)

BRIGGS, K.G.
Effects of plant density and competition on selection methods used for the genetic improvement of six row barley (1977-1978)

COLOTELO, N.
Role of exudates from aerial mycelium of sclerotiorum and Fusarium species in pathogenesis (1973-1974)

HIRUKI, C.
Serological and anatomical studies on plant mollicute diseases with special reference to their diagnostic value (1979-1980)

KNOWLES, R.H.
An evaluation of the behaviour of turfgrass species to variations in management practices (1968-1969)

KNOWLES, R.H.
An evaluation of the use of a portable plastic greenhouse and hot air heating on the forcing of strawberries on a commercial scale (1974-1975)

KONDRA, Z.P.
Evaluation of genetic variability in breeders' seed of licensed varieties and advanced selections of rape (B. napus L.) (1977-1978)

TOOP, E.W.
The effect of cultural procedures on the bulbing and flowering of tulips (1975-1976)

VANDEN BORN, W.H.
Chemical control of wild oats (1974-1975)

VANDEN BORN, W.H., D.K. McBEATH
Integrated wild oat control: herbicide-fertilizer interactions (1975-1976)

WALTON, P.D.
Seed and forage yield testing of improved grass cultivars (1979-1980)

RURAL ECONOMY

APEDAILE, L.P.
Assessment of technical input/output relationship in northern Alberta (1968-1969)

GILLS, D.S.
An exploration into the nonformal education needs of rural women in a selected area of Alberta and their relationship to three selected programs (1976-1977)

LEROHL, M.L., M.H. HAWKINS
Canadian grade standards for wheat and export market potential (1978-1979)

PETERSEN, T.A.
Development of a farm management simulation model for teaching and research (1973-1974)

VEEMAN, M.M.
An investigation into Alberta fluid milk quota practices (1978-1979)

SOIL SCIENCE

COOK, F.D., F.V. MacHARDY
Measurement of photosynthate requirement for nitrogen fixation by selected free-living microorganisms found in Alberta soils (1977-1978)

COOK, F.D.
Inoculum for pulses (1979-1980)

CROWN, P.H.
An assessment of the deep plowing potential of solonetzic soils in the Leduc area, Alberta (1978-1979)

MacHARDY, F.V.
Assessment of nitrogen contribution to cereals by intercropping with annual legumes (1977-1978)

NYBORG, M.P.K.
Soil testing — evaluation and improvement (1969-1970)

PLUTH, D.J.
Productivity ratings for soil types in Edson and Whitecourt map areas (1968-1969)

PLUTH, D.J.
Nutrient distribution and cycling in selected forest ecosystems (1968-1969)

ROBERTSON, J.A.
Available phosphorus in Alberta soils (1976-1977)

ROBERTSON, J.A.
K status of soils in northeastern Alberta (1979-1980)

WEBSTER, G.R.
Testing of a revised soil-moisture budget (1978-1979)

INTERDISCIPLINARY

ANDREW, W.T., E. RAPP
Supplementary irrigation and fertigation of netted gem and Norland potatoes (1974-1975)

ANDREW W.T., K.W. DOMIER
The intergration of seed pieces, cutters and planters for better plant stands in potato fields (1977-1978)

BERG, R.T., Z.J. HAWRYSH, M.A. PRICE
Assessment of optimum slaughter weight and condition in beef cattle (1979-1980)

CLEGG, L.F.I., W.T. ANDREW
Fertilizer and trace element studies (1974-1975)

DOMIER, K.W., J.A. ROBERTSON
Fertilizer placement in tilled and untilled soils (1979-1980)

MECHANICAL ENGINEERING

BELLOW, D.G.
Measurement of loads on a cultivator shank (1979-1980)

SIMON FRASER UNIVERSITY

BORDEN, J.H.
Pheromones and host attractants for stored grain insects (1978-1979)

UNIVERSITY OF BRITISH COLUMBIA

COPEMAN, R.J.
Serological detection methods for Corynebacterium sepedonicum (1977-1978)

UNIVERSITY OF CALGARY

BENN, M.H.
Larkspur cattle-poisoning (1979-1980)

COSTERTON, J.W.
Bacterial colonization of the surfaces of cells of the digestive tract (1977-1978)

VETERINARY INFECTIOUS DISEASE ORGANIZATION

ACRES, S.D.
Living vaccine against calf scours caused by enteropathogenic E. coli (1978-1979)

BIGLAND, C.H.
Studies of mycoplasmas in bull semen and their transmission in a bull station (1978-1979)

WESTERN COLLEGE OF VETERINARY MEDICINE

FORSYTH, G.W.
Control of intestinal secretion in colibacillosis in pigs (1978-1979)

GUDMUNDSON, J., M.E. SMART
A survey of trace mineral metabolism in purebred and percentage Simmental cattle (1978-1979)

POLLEY, L.R.
A necropsy study of the occurrence of selected helminth parasitisms among horses in western Canada (1979-1980)

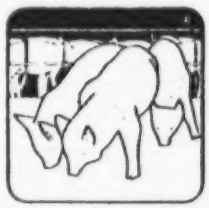
RADOSTITS, O.M.
An in-depth study of neonatal diarrhea in calves (1972-1973)

RAWLINGS, N.C.
The endrocrinology and physiology of blastocyst implantation in the ewe (1978-1979)

SAUNDERS, J.R., S.M. OLSON, C.H. BIGLAND
Studies on the prevention and epidemiology of bovine Haemophilus *septicemia (Thrombo-embolic Meningo-Encephalitis — TME)* (1978-1979)

STOCKDALE, P.H.G.
Immunological control of shipping fever in cattle (1979-1980)

NEW GRANTS — EFFECTIVE 1980



ANIMAL SCIENCE

AHERNE, F.X.

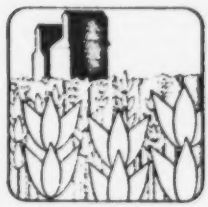
The use of electrolytes and crude immunoglobulins in curing and preventing pre-weaning and post-weaning scours in pigs

To determine the effectiveness of electrolytes and/or a crude immunoglobulin extract from abattoir pig blood in the prevention of neonatal and post-weaning pig scours. The reduced performance and mortality associated with post-weaning scours can result in considerable economic loss to swine producers. While antibiotics are used widely in both prevention and treatment of scours, the development of resistant strains of *E. coli* often renders them ineffective and gives rise to public concern that drug resistant strains of organisms might be transferred to man. Therefore it would be of great value if γ-globulins, (immunoglobulins) and/or electrolytes could be used in preventing and curing scours in young pigs.

BERG, R.T., M.A. PRICE, R.T. HARDIN

Strategies for beef cattle improvement

To attempt to develop an integrated, comprehensive breeding program and selection criteria for commercial beef cattle operations. With the increased use of crossbreeding and breed synthesis of specialized strains, it is important to know best breeding and selection strategies for maximizing productivity in beef operations.



PLANT SCIENCE

BENN, M.J.

Alsike clover hepatotoxin

Alsike clover poisoning of horses is a chronic problem in the Peace River region. The toxin is a liver poison, but its chemical nature is unknown. We propose to identify the toxins, and in doing so devise a prophylaxis for animals pastured on Alsike clover.

CLARK, E.A.

Interspecific competition in pastures under continuous and rotational grazing management

The objectives are (1) to quantify changes in species composition and in the productivity of individual species over time, in response to grazing management and, (2) to determine how these changes occur, emphasizing interspecific interaction and the influence of grazing on the crop microenvironment. Results will have application in formulating specific management recommendations and in predicting pasture performance over a range of growing conditions.

KNOWLES, R.H.

The behaviour of turfgrass growing on minimal medium in response to irrigation and nutritional inputs

By alternating the non-capillary porosity of the soil beneath turfgrass, we have been able to effect (1) striking changes in the morphological characteristics of turfgrass; (2) improve its resistance to winter injury and (3) change its ability to compete with weeds and weedy grasses. These observations suggest that when turfgrass is grown on a physically minimal medium, growth can be more readily manipulated to react quickly and favourably to stressful conditions. The objectives of this proposed study would be to measure reaction and reaction time of turf grass to cultural inputs when grown on a minimal medium.

KONDRA, Z.P.

Rapeseed growth analysis as related to crop maturity and seed yield

The major obstacle to high yield per acre in Alberta is the long maturity requirement of high yielding *B. napus* varieties. Preliminary growth analysis studies indicate that considerable genetic variability exists for time to growth stages, rates of development and seed yield. A detailed study on a wide range of genotypes is required to determine the potential for combining early maturity and high yield. The objective is to develop genotypes of *B. napus* with a maturity requirement equal to that of current *B. campestris* varieties.

RURAL ECONOMY

HAWKINS, M.H., R.R. NORBY

Meat price relationships — farm, wholesale and retail

To examine meat prices, on a carcass basis, throughout the market channels at the farm, wholesale and retail level and to evaluate these relationships with respect to pricing efficiency and market performance criteria. To provide some understanding of the market place and how producers and consumers are affected by it.

HAWKINS, M.H., M.M. VEEMAN

Market innovations and price behaviour — Alberta hogs

To evaluate the market performance and the pricing efficiency of the Alberta Pork Producers Marketing Board over time. To document the historical changes in Alberta Pork Producers Marketing Board selling. To update Faculty of Agriculture and Forestry Bulletin #12. "Development and operation of the Alberta Pork Producers Marketing Board".

MANNING, T.W.

The potential impact of rising energy prices on the use and allocation of resources in grain production

The purpose of this study is to determine the effects of rising energy costs on grain producers. The study is intended to help answer the question of what changes are likely to occur in prairie grain production during the next decade. Specifically, the study will seek to project energy costs to grain producers, to determine the effects of rising energy costs on the input mix and the output mix, and to examine possible technological adjustments to rising energy costs. The research will be planned and conducted in such a manner as to be complementary to a related study of rising energy prices by W.M. Schultz. While the two proposed studies are independent, we propose to share information and procedures in order to facilitate completion of both projects.

PETERSEN, T.A.

Analysis of farm leases and rental arrangements in Alberta

To examine the various types of farm rental arrangements which exist in Alberta; to evaluate their "fairness" in terms of both the lessor and lessee, in terms of economic and social criteria, and to suggest ways in which the general quality of farm rental arrangements in Alberta can be improved. This is an important consideration with the trend toward land ownership as an inflation hedge by non-farmers, and a growing number of unique rental arrangements, some of which are not soundly based on accepted economic criteria.

PETERSEN, T.A.

The economics of continuous cropping in the dark brown soil zone of Alberta

To examine the economic aspects at the farm level, of reducing summerfallow acreage in the dark brown soil zone of Alberta; an examination of the main factors affecting the farm operator's decision to reduce fallow acreage in his cropping program; identification of those areas in Alberta where fallow reduction may be feasible. Economic reduction of fallow will increase farmers' net incomes, and increase Alberta's agricultural output.

SOIL SCIENCE

NYBORG, M.

Rate of oxidation of elemental sulphur fertilizers

Deficiency of sulphur occurs on approximately 10% of the agricultural land in western Canada. While sulphur deficiency affects all the important crops, rapeseed is especially sensitive and total crop failure can result from the deficiency. Commercial sulphur fertilizers are based on sulphate salts or elemental sulphur. However, preliminary results indicate that elemental sulphur may supply sulphate so slowly that it is of little use to crops; and it is the purpose of this project to determine if elemental sulphur is inherently inferior as a sulphur fertilizer for western Canada.

INTERDISCIPLINARY

ANDREW, W.T., K.W. DOMIER

A systematic study of potato cutters, seed pieces and planters

To determine the changes needed in potato cutters to produce seed pieces that are most suitable for planting with existing potato planters and result in better stands and increased yields. A systematic study of the inter-relationship between cutters, seed pieces and planters can pinpoint the design changes needed to increase the marketable yield and decrease the yield losses from gaps and doubles.

NYBORG, M., K.W. DOMIER

Placing fertilizer in bands or nests

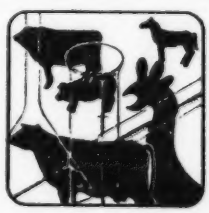
Under previous work supported by the Alberta Agricultural Research Trust, it was shown that fall-application of nitrogen fertilizers was only about half as effective as spring-application. Other factors of timing and methods of application were important as well. The placing of the fertilizers as nests or big pellets was a surprisingly effective technique, and the placing in bands showed some promise. This project has two objectives: (1) to substantiate these findings and to better define the most effective depth, spacing and time of placing nitrogen fertilizer, in bands, nests or bands; and (2) to design practical devices for placing nitrogen (and phosphorus) fertilizer in these ways. That is, the objective is to bring these results into use by the farmer.

UNIVERSITY OF CALGARY

COSTERTON, J.W.

Evaluation of forage crops by in vitro digestion with rumen bacteria

The use of legume pastures to support ruminants is very favorable nutritionally, but their use is limited by the tendency of some legumes to cause frothy bloat. The assessment of plant breeding programs designed to produce "bloat safe" cultivars must presently rely on expensive and time-consuming animal experiments. We have developed a procedure, in close cooperation with Agriculture Canada scientists, in which forage leaves are incubated with rumen bacteria "in vitro" and in which the tendency to cause frothy bloat can be detected by loss of dry matter, by gas and foam production, and by the speed of leaf tissue penetration by the bacteria. The refinement of this procedure will allow quick and economical assessment of the bloat characteristics of large numbers of legumes.



WESTERN COLLEGE OF VETERINARY MEDICINE

OSBORNE, A.D., J.R. SAUNDERS

Investigation of the pathogenesis of pneumonia resulting from infection by Haemophilus pleuropneumoniae

Porcine pneumonia due to *Haemophilus pleuropneumonia* infection is a disease which is frequently fatal in animals 6-30 weeks of age. Alternatively it results in a pleurisy which significantly affects economic performance. The objective is to define the conditions which predispose to the development of clinical disease in order to more thoroughly assess the value of preventive measures.

CONTRIBUTIONS
from sources listed are gratefully acknowledged
April 1, 1980 - March 31, 1981

Aimers Seed Ltd.
Alberta Pork Producers Marketing Board
Alberta Potato Commission
Alberta Wheat Pool
Beefboosters Cattle Ltd.
Big Lake Sod Farms Ltd.
Bluegrass Sod Farms Ltd.
Cominco Ltd.
Dow Chemical Ltd.
Forcrest Foods Ltd.
Gem Sod Farms Ltd.
Hannas Seeds Ltd.
Imperial Oil Ltd.
National N-K Seeds Ltd.
Oseco Western Ltd.
Otto Pick and Sons Seeds Ltd.
Potash and Phosphate Institute
Rothwell Seeds Ltd.
Simon Fraser University
University of Saskatchewan
University of Saskatchewan Endowment
Western Co-op Fertilizers Ltd.

ALBERTA AGRICULTURAL RESEARCH TRUST
FINANCIAL STATEMENTS
MARCH 31, 1981

AUDITOR'S REPORT

To the Trustees of the
Alberta Agricultural Research Trust

I have examined the balance sheet of the Alberta Agricultural Research Trust as at March 31, 1981 and the statement of revenue, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Trust as at March 31, 1981 and the results of its operations for the year then ended in accordance with the disclosed basis of accounting described in Note 2 to the financial statements applied on a basis consistent with that of the preceding year.

Douglas W. Rogers, C.A.
Auditor General

Edmonton, Alberta
November 3, 1981

Statement A

ALBERTA AGRICULTURAL RESEARCH TRUST
BALANCE SHEET
AS AT MARCH 31, 1981

	1981	1980
ASSETS		
Current: Deposits in trust (Note 3)	$29,119	$14,787
LIABILITIES		
Unexpended funds, Statement B	$29,119	$14,787

The accompanying notes are part of these financial statements.

Statement B

ALBERTA AGRICULTURAL RESEARCH TRUST
STATEMENT OF REVENUE, EXPENDITURE AND UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 1981

	1981	1980
REVENUE		
Contributions from the Province of Alberta— Department of Agriculture	$250,000	$315,510
Contributions from industry	131,109	142,971
Interest	21,906	12,781
	403,015	471,262
Research grants	368,227	547,643
Administration charge	20,456	24,398
	388,683	572,041
Excess of revenue over expenditure	14,332	(100,779)
Unexpended funds at beginning of year	14,787	115,566
Unexpended funds at end of year	$ 29,119	$ 14,787

ALBERTA AGRICULTURAL RESEARCH TRUST
NOTES TO FINANCIAL STATEMENTS
MARCH 31, 1981

Note 1 Authority

The Alberta Agricultural Research Trust operates under the authority of The Alberta Agricultural Research Trust Act, Chapter 4, Statutes of Alberta 1970.

Note 2 Significant Accounting Policies

These financial statements have been prepared in accordance with generally accepted accounting principles except that research grants expenditure is recorded on a cash basis.

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3 Deposits in Trust

Deposits in trust consist of deposits in the Consolidated Cash Investment Trust Fund of the Province of Alberta.

Note 4 Approval of Financial Statements

These financial statements were approved by management on November 3, 1981.